# Integrated Media Systems Center

## University of Southern California

### Revolutionizing the way we work, play, teach, and learn

*A National Science Foundation Engineering Research Center since 1996*

After a decade of anticipation, multimedia technology is finally poised to dramatically change the way we work, play, teach, and learn. Defined as the creation and packaging of information, as well as its dissemination and distribution through end-user interactive applications, multimedia currently embraces technologies spanning four distinct industries—entertainment, telecommunications, publishing, and computer hardware and software. However, the technology promises a future without boundary in any single discipline or industry. In practical terms, this burgeoning technological expansion—multimedia is estimated to grow to a $40 billion industry by the year 2000—will require an equally large global workforce to grow along with it. For instance, in California alone, close to 80,000 multimedia-related jobs are expected to be created over the next 4 to 5 years.

The goal of the Integrated Media Systems Center (IMSC) is to combine basic science and innovative research into new technologies with highly interactive industry collaboration and inventive education programs to create integrated media systems. These new multimedia systems will expand our access to information, simplify authoring in mixed media, and enable the real-time dissemination of interactive media.

IMSC's deeply cross-disciplinary efforts have been organized into three interrelated thrusts: (1) enhanced, simplified creator-computer and computer-consumer interfaces; (2) rapid, robust compression and exchange of multimedia modules; and (3) effective access, sharing, manipulation, and presentation of multimedia databases to diverse users. The research efforts are synergistically strengthened by industrial partnerships that make technology transfer an ongoing process.

Multimedia promises to usher in a profound paradigm shift in both the classroom and the workplace. Using multimedia systems in the classroom—including networked computers, realtime interactive video, and immersive audio—students and teachers will be able to work together interactively in a variety of ways. For example, a high school physics class could consist of "virtual study groups." In these groups, students using networked computers equipped with programs designed to be used by many students at the same time could perform simulated experiments together, even though the students may be located miles—or even continents—away. Other applications include databases capable of providing precise information in a variety of media, including text, video and audio, and interactive learning methodologies capable of exposing students to the elegance of complex science subjects.

In business, the possibilities are equally profound. Like the virtual study group, employees will soon be able to gather in "virtual meetings," using telepresence devices that employ video and immersive audio to bring together workers located at different sites. Integrated media systems will also make it possible to move to an office setting where documents are created, disseminated, and stored electronically instead of having to rely entirely on paper-based documents.

**Research**

IMSC's overall research strategy is based on overcoming four barriers in the current state of this technology:

- Computer interfaces that are predominately unidirectional and inefficient
- Expensive real-time distribution and storage of multimedia data

**Virtual conference room with immersive visual and aural sensory displays.**

- Lack of an effective methodology for managing large integrated or distributed-media databases
- Costly and time-consuming production and testing of integrated media products for education, training, manufacturing, the arts, mass communication, and entertainment.

Accordingly, the research goals of the Center are focused on surmounting these key technical barriers. The Center's four major goals are to:

- Develop perceptive interfaces for truly interactive media systems for creator-computer and computerconsumer interfaces.
- Provide high-bandwidth information delivery with real-time artifact-free (relative to human perception) compression and decompression.
- Allow automatic indexing and synchronous access to multiple audio and video streams from distributed and heterogeneous databases.
- Devise low-cost, end-user-interactive media modules that enhance educational and workforce effectiveness.

**Research Thrusts**

IMSC investigators include faculty from USC's School of Engineering, Annenberg School for Communication, School of Cinema-Television, School of Music, and School of Education. They have focused their efforts on three research thrusts:

- *Creator-Computer-Consumer Interfaces (C3I)* explores the interface between humans and computers using smart cameras, 3-D displays, closed-loop tracking, immersive sound reproduction, and automatic speech recognition.
- *Media Interconnection and Delivery Fabrics (MIDF)* develops technologies for high-speed wired and wireless communication networks, including artifact-free compression technology.
- *Distributed Multimedia Information Management (DMIM)* tackles the issues of how to store, index, structure, manipulate, and present multimedia information through dramatically advanced digital image, video, and audio databases.

**Interactive multimedia interfaces for new paradigms in education.**

Since all viable integrated-media applications draw components from each of the research thrusts, IMSC also employs key Systems Integration Experiments (SIEs) to provide intensive intra-thrust and cross-thrust interactions and integration as well as technology transfer.

**Education**

A key component of IMSC is its education programs, including a new graduate program that provides students with a background in both applications development and engineering technologies and a group of undergraduate courses where the curriculum is driven by the Center's state-of-the-art research.

Other programs include the Multimedia University Academy, where high school students master skills that will make them employable in the growing integrated-media market, and a retraining and continuing education program for dislocated workers. In addition to its value to the community, IMSC's efforts to train and place "technosavvy" workers in multimedia is critical to the industry's emerging workforce needs. The curriculum of these unique training programs is currently being expanded into a 2-year program with an enhanced interdisciplinary approach, intensive training in multimedia technologies, and the opportunity to develop multimedia applications.

In addition to these efforts, IMSC is committed to advising and supporting other institutions and organizations as they introduce multimedia into their workplace or classroom.

**Industrial Collaboration/Technology Transfer**

The IMSC engineering paradigm of "cooperative interactivity" is expressed in many ways throughout the Center's programs, but perhaps most directly in IMSC's university-industry interactions, with their emphasis on integrating the IMSC vision and research efforts of academic and industrial partners at all levels.

For example, IMSC has established liaisons with more than 40 companies through individual research projects and the IMSC Industrial Partners program. The Center also participates in NASA's Far West Regional Technology Transfer Center, which provides market analysis for emerging technologies and works with the Los Angeles Regional Technology Alliance through the Information Technology Consortium. This Consortium brings together defense and commercial companies and service providers that focus on integrated processing and communication of information in multimedia formats. IMSC also encourages spin-off companies by defining technological boundaries and offering access to resources and labs.

**Facilities**

IMSC occupies more than 12,000 square feet, which houses the Center headquarters, student and faculty offices, and laboratories and includes a newly completed state-of-the-art laboratory for augmented reality, animation and graphics, "immersivision," and databases.

---

*Center Headquarters*

Integrated Media Systems Center
University of Southern California
3740 McClintock Avenue, Suite 131
Los Angeles, CA 90089-2561
Phone: (213) 740-9813
Fax: (213) 740-8931
Homepage: http://imsc.usc.edu/

Center Director: Dr. Chrysostomos L. (Max) Nikias
email: nikias@imsc.usc.edu

Deputy Director: Dr. Alexander A. Sawchuk
email: sawchuk@imsc.usc.edu

Executive Administrative Director: Ms. Susan S. Lewis
email: slewis@imsc.usc.edu

NSF 96-23z